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ABSTRACT

A study sought to determine if there is a relationship between certain types of school districts and demand for greater number of teachers in certain teaching specialties. These relationships were determined by using muliple regression, contingency table analysis, and cluster analysis methods with data from the 1979-80 Sample Survey of Teacher Demand and Shortages, the 1970 Census School District Fifth Count File, and other instruments. Findings revealed that teachers of cultural subjects and of gifted pupils were in greatest demand in affluent, highly educated communities composed of professional people with small families. These communities also demanded more science and mathematics teachers. Vocational education teachers were in demand in communities where poverty was relatively great, the district small and rural, education low, and government funding high. Tables present information on teacher demand based on teaching specialities variables: (1) culture and enrichment; (2) home economics, industrial arts, and business; (3) mathematics and science; (4) English language arts and social studies; (5) special education for handicapped; (6) health and physical education; (7) the nonspecial education problem learner; and (8) vocational education. Appendixes contain information on: school district cluster descriptions; factor formation (principal axis factor analysis, followed by varimax rotation, which was used to separate the variables into independent factors); and a listing of data sources. (JD)

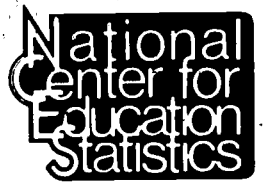
Teacher Demand: A Sociodemographic Phenomenon

by

Jane L. Crane

National Center for
Education Statistics

NCES 82-118



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Foreword

Does the demand for teacher specialists vary from community to community? If so, what sociodemographic characteristics of those communities are related to this difference in demand?

These questions are examined for specialists teaching in the 1979-80 school year. The sociodemographic characteristics of the communities in which they taught were derived essentially from 1970 U.S. Census Data.

This report develops a methodology whereby demand for teacher specialists can be pinpointed. Given information on the type of communities where their skills are in most demand, teacher specialists can improve their job search efforts.

Norman D. Beller
Assistant Administrator for
Elementary and Secondary
Education Statistics
December 1982

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Summary

This study was undertaken to determine if communities that differ in such characteristics as education level, wealth, ethnic makeup, type of educational funding, urbanicity, size, etc., would also differ in their demand for teacher specialists. Three different techniques were used to measure the association between these characteristics and the demand for teacher specialists: multiple regression, contingency table analysis and an anaysis of cluster means.

For two types of teacher specialists, all three methods of analysis showed strong and consistent relationships. Teachers of culture (i.e., art, foreign language, and music) and of gifted and talented pupils were in greatest demand in affluent, highly educated communities, where a large proportion of the population was employed in professional jobs and family size was relatively small. The vocational education teacher, on the other hand, was in greatest demand in communities where poverty was relatively great, the district was small and rural, the education level was low and Federal/State funding of vocational education was high.

For the other teacher specialists, either the associations were not as strong or were not discovered by all three techniques. Even though these associations were not as evident, because of current concern with a shortage of math/science teachers, it is worthy to note the results for these specialists here. Communities which are generally affluent, educated, and professional employ more secondary-level math/science teachers. Likewise, these same communities tend to have low percentages of persons from non-English-speaking backgrounds and minimal Federal/State funding of vocational education. Elementary-level math/science teachers are in greatest demand in communities where education, affluence and the number of professionals is high.

The findings of this study reveal that the demand for teacher specialties is related to the sociodemographic characteristics of the communities served. In some sense these characteristics can be used as quantifiable, albeit quite imperfect, surrogates for the local communities' requirements on the school system. If this assumption is valid, then the study shows that demand for teacher specialties responds to perceived community needs. More current data on the characteristics of the communities may further support this assertion.

The reader should be apprised of certain limitations of the data and the analyses before applying the results of this study. First, the 1970 Census file was the only file available at the time of the study. The sociodemographic variables supplied in this file are badly out of date -- a poor match for the 1979-80 school districts. Secondly, sampling weights were not used, so a potential bias exists in the analyses to the extent that the sample of LEA's drawn differed from random sampling.

Despite these shortcomings, this analysis was undertaken in an exploratory manner to ascertain the difficulties that would be encountered and prepare for a similar type of analysis using 1980 Census data. The experience of this endeavor should certainly enhance future efforts.

Introduction

During the 1970's, reports from various sources indicated a bleak outlook for teachers in the job market. According to the 1976 Survey of Recent College Graduates (RCGS), 51 percent of bachelor's recipients, newly qualified to teach, who applied for teaching jobs, obtained full-time positions. By 1978, that percentage had increased to 64 percent. However, this demand was not uniform across all specialities. According to the 1978 RCGS, Graduates eligible to teach special education and those eligible to teach mathematics, who applied to teach, obtained full-time teaching positions at the rate of 75 percent and 70 percent respectively. The rate of success in landing a full-time position was much worse for some specialties: Forty-nine percent for those eligible to teach music and only 28 percent for those eligible to teach art.

In the early 1980's, however, the birth rate began increasing for the first time in 10 years; fewer people were going into the teaching profession (especially in the science and mathematics fields); budget cut-backs were pressuring school districts to drop teachers from their staffs; and many districts around the country started reporting shortages. In other words, the situation is changing rapidly, dramatically and not uniformally.

National statistics for the 1979-80 school year revealed that teacher layoffs and shortages have occurred in very small numbers compared with the total teacher workforce. (Shortages represented 0.4 percent of the 2.6 million teachers in the Nation and layoffs 0.9 percent.) These statistics, however, may hide the fact that certain types of communities (i.e., those with certain demographic characteristics) have shortages of certain teacher specialties or will experience such shortages soon, since their demand for these specialties is greater than average. The purpose of this study, then, was to determine if there is a relationship between certain types of districts and demand for greater numbers of teachers in certain teaching specialties.

This objective was realized using multiple regression, contingency table analysis and cluster analysis with data from the 1979-80 Sample Survey of Teacher Demand and Shortages, the 1970 Census School District Fifth Count File and others (see appendix III for more details). Multiple regression is a general statistical technique through which one can analyze the relationship between a dependent variable and a set of independent or predictor variables. Cluster analysis is a statistical technique that groups observations with

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[1]U.S. Department of Education, National Center for Education Statistics, New Teachers in the Job Market, Survey of 1976-77 Graduates, Spring 1978.

similar characteristics into a small number of homogeneous clusters so that means among clusters can be compared. Contingency table analysis examines the distribution of two or more classification variables. The joint frequency distribution can then be statistically analyzed by certain tests of significance, e.g. the chi square statistic, to determine whether or not the variables are related.

Each method of analysis in this study supplied a different perspective on these relationships. For multiple regression, we looked at the linear relationship between characteristics of school districts and specialist demand. In contingency table analysis, we looked for associations (not necessarily linear) between quartiles of the characteristics of school districts and teacher demand. For cluster analysis, school districts with similar characteristics were compared with respect to their teacher demand.

Study Design

Multiple Regression

The independent variables for the multiple regression were created by reducing over 100 sociodemographic variables to six major factors through a principal axis factor analysis. Factor analysis uses an iterative process to estimate the communality of each variable. It then searches for the last reduced-rank solution of the matrix of correlations among the variables and on that basis separates the sets of related variables into independent factors. The main aim of this technique is concise description.

The factors that emerged in order of strength were as follows:

1. affluence, professional, education
2. poverty
3. urban/size
4. percent persons with non-English speaking background
5. Federal/State vocational education funding
6. child/adult ratio

See appendix II for a more complete description of how these factors were formed.

A multiple regression equation was developed for each teacher specialty. Demand for that specialty was predicted using the six factors as predictor variables. A significant R^2 for the overall equation revealed where there was a relationship between demand for a teacher specialist and community characteristics. The analysis of the regression coefficients indicated the specific factors that contributed significantly to the overall relationship. These are measured by the t statistic.

Contingency Table Analysis

The quartiles of each factor variable[2] and each demand variable were crosstabulated. A chi square test statistic was used to reveal when there was an association between the quartiles of one distribution and the quartiles of the other.

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[2]The factor scores were ordered from high to low and the distribution divided into four equal parts, with the bottom 25 percent of the factor score distribution forming the lowest or fourth quartile.

Cluster Analysis

Scholastic Inc., publishers of magazines, books and instructional material for elementary and secondary classrooms, contributed cluster group identifiers for the school districts in the sample. Scholastic uses these cluster designations to dovetail its marketing campaigns to the specific needs and wants of similarly grouped districts. Based on the complete range of 1970 Census information and on an extensive amount of correlative district-specific data, eight major district group categories containing 40 district cluster types were identified. These eight classifications were used in this study.

The mean demand for each category of teacher specialist was tallied by these eight groups. A test of significant difference among the means utilizing analysis of variance, followed by a test for post-hoc comparisons, indicated where cluster group membership was related to demand for a particular teacher specialty.

Teacher Specialties

Data on 146 teaching specialties for both the elementary and secondary-levels were gathered from the 1,273 school districts in the sample. The specialties were then grouped to cut down on the number of analyses necessary. The groupings were as follows:

1. Culture and enrichment teachers
   - Art
   - Foreign languages
   - Music
   - Gifted and talented

2. Practicum-of-living teachers
   - Home economics (nonvocational)
   - Industriaal arts (nonvocational)
   - Business (nonvocational-secondary only)

3. Math/science teachers
   - Math
   - Science

4. Core teachers
   - English language arts
   - Social studies

5. Special education teachers
   - Mentally retarded, hard of hearing, deaf, speech-impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, other health-impaired, specific learning disabled, deaf/blind, multihandicapped

6. Health, physical education teachers
   - Boys
   - Girls
   - Combined or nonspecified

7. Teachers for the (nonspecial education) problem-learner
   - Reading
   - Bilingual education
   - Basic remedial (secondary only)

8. Vocational education teachers (secondary only)

Teacher Specialties as Demand Variables

Demand for each specialty grouping was measured in two ways:

1. As a proportion, e.g., $\frac{\text{Number of teachers in specialty per district}}{\text{Total teachers per district}}$

2. As a ratio, i.e., $\frac{\text{Number of teachers in specialty per district}}{\text{Total number of students/1,000 per district}}$

For each of the three methods of analysis and for each teacher specialty, both methods of measuring demand were used.

Elementary and secondary demand variables were analyzed separately. For an elementary-level specialist, elementary-only districts were included as well as the elementary teachers (and elementary students) in a combined district. For a secondary-level specialist, secondary-only districts were included as well as the secondary-level specialists (and secondary students) in a combined district.

Districts associated with an intermediate district for special education, vocational education, or both were eliminated from the sample.

Results

Multiple Regression

Although statistically significant relationships were found for all of the regression equations (due to the large sample size), the overall strength of those relationships was usually weak. For example, on the average, the factors only accounted for about 18 percent of the variability in the dependent variables for teacher specialists at the secondary-level, and only 9 percent of the variability in the dependent variables for those specialists at the elementary-level. This index to measure the ability of the independent variables to predict the criterion is called a multiple correlation coefficient, R^2.

Overall Results, Multiple Regression

The sociodemographic factors showed a strong relationship ($R^2 = .29$) with only three teacher demand variables (all at the secondary-level): culture teachers, vocational education teachers and practicum-of-living teachers (see table 1).

To a lesser extent ($R^2 = .15$ to $.28$), the variability in demand was explained for culture teachers (elementary), math/science teachers (secondary), and problem-learner teachers (secondary).

Table 1.—Relative teacher demand, by level, specialty, and strength of overall prediction equation

Teacher specialty, by level	Strength of overall prediction equation as measured by R^2	n
Elementary		
– Culture teachers as proportion of total teachers (includes art, music, foreign language and gifted and talented)	.21	840
– Culture teachers per 1,000 students	.18	840
– Practicum-of-living teachers per 1,000 students (includes home economics and industrial arts)	.02	840
– Practicum teachers as proportion of all teachers	.02	840
– Math/science teachers as proportion of all teachers	.08	840
– Math/science teachers per 1,000 students	.06	840
– Core teachers as proportion of all teachers (includes English language arts and social studies)	.04	840
– Core teachers per 1,000 students	.05	840
– Special education teachers as proportion of all teachers (includes teachers of mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, other health impaired, specific learning disabled, deaf/blind, and multihandicapped)	.08	840
– Special education teachers per 1,000 students	.05	840
– Physical education teachers as proportion of total teachers	.12	840
– Physical education teachers per 1,000 students	.13	840
– Problem-learner teachers as proportion of total teachers (includes reading, bilingual and basic remedial teachers)	.09	840
– Problem-learner teachers per 1,000 students	.09	840

Table 1.—Relative teacher demand, by level, specialty and strength of overall prediction equation—continued

Teacher specialty, by level	Strength of overall prediction equation as measured by R^2	n
Secondary		
— Culture teachers as proportion of total teachers (includes art, music, foreign language, gifted and talented)	.37	883
— Culture teachers per 1,000 students	.33	883
— Practicum-of-living teachers as proportion of total teachers (includes business, home economics, industrial arts—all non-vocational)	.25	883
— Practicum-of-living teachers per 1,000 students	.29	883
— Math/science teachers as proportion of total teachers (includes mathematics, biology, chemistry, general science, physics, and other)	.16	883
— Math/science teachers per 1,000 students	.13	883
— Core teachers as proportion of total teachers (includes English language arts, and social studies)	.04	883
— Core teachers per 1,000 students	.10	883
— Special education as proportion of total teachers (see elementary level for handicaps)	.08	883
— Special education per 1,000 students	.04	883
— Problem-learner teachers as proportion of total teachers (includes reading, bilingual education, secondary basic skills, and remedial education)	.15	883
— Problem-learner teachers per 1,000 students	.13	883
— Physical education teachers as proportion of total teachers	.07	883
— Physical education teachers per 1,000 students	.01	883
— Vocational education as proportion of all teachers (includes the following specialties: agriculture, distribution, health, occupational home economics, office occupations, technical trade and industrial, other vocational education)	.43	883
— Vocational education teachers per 1,000 students	.31	883

All other relationships for the multiple regressions, although significant, were not of sufficient strength to merit further examination.

Factors Contributing to Overall R^2 for Specialties (see table 2)

When reviewing this table, keep in mind that the model is additive and the R^2 is the result of the weighted combination of the factors. Thus, looking at one factor independently of others may give a misleading perspective.

Culture Teachers (Elementary and Secondary)

At both levels, the negative coefficient for the poverty factor indicates that where poverty is minimal, culture teachers are more likely to be hired. Similarly, the higher the level of education and affluence in a community and the higher the number of professionals, the more likely it is that culture teachers will be hired. Significant negative coefficients were also found at both elementary and secondary-levels for these factors: percent persons from non-English-speaking backgrounds,[3] Federal/State funding for vocational education, and child/adult ratio. Only the urban/size factor played no role in predicting demand for culture teachers.

Therefore, demand for culture teachers is highest in school districts that are affluent, well-educated and professional, with low concentrations of persons from non-English-speaking backgrounds and few children relative to the adult population.

Practicum-of-Living Teachers (Secondary)

The poverty factor with a negative coefficient seems to be a strong predictor of demand for this type of specialist. Child/adult ratio and Federal/State funding for vocational education factors also showed negative relationships with demand for practicum-of-living teachers. (Keep in mind that a negative coefficient means that a high score on the factor is associated with low demand and high demand is associated with low scores for those factors.) The percent persons from non-English-speaking backgrounds factor had a positive coefficient, i.e. the more persons with non-English-speaking backgrounds in the community, the greater the demand for these teachers.

Therefore, more practicum-of-living teachers are hired in districts that are well-off financially, have few children relative to the adult population and have relatively high concentrations of persons from non-English-speaking backgrounds.

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[3]Only significant for secondary when demand is expressed as a ratio (per 1,000 students).

Table 2.—Relative teacher demand, by level, specialty, and strength of individual factors (for teacher specialties producing overall R^2 of .15 or higher)

Teacher speciality, by level	R^2	Factors	Coefficient estimate	t ratio	n
Elementary					
Culture (proportion)	.21	1 affluence, education, professional	.0067	6.4	840
		2 poverty	−.0083	−9.4	
		3 size/urban	.0015	1.7	
		4 non-English speaking	−.0074	−7.6	
		5 Federal/State vocational aid	−.0051	−3.5	
		6 child/adult ratio	−.0036	−4.0	
Culture (per 1,000 students)	.18	1 affluence, education, professional	.2748	4.5	840
		2 poverty	−.4019	−7.9	
		3 size/urban	−.0231	−.5	
		4 non-English speaking	−.2963	−5.3	
		5 Federal/State vocational aid	−.2785	−3.4	
		6 child/adult ratio	−.3774	−7.1	
Secondary					
Culture (proportion)	.37	1 affluence, education, professional	.0118	12.9	883
		2 poverty	−.0140	−17.8	
		3 size/urban	.0009	1.2	
		4 non-English speaking	−.0015	−1.6	
		5 Federal/State vocational aid	−.0052	−6.3	
		6 child/adult ratio	−.0035	−4.0	
Culture (per 1,000 students)	.33	1 affluence, education, professional	.9373	12.0	883
		2 poverty	−.9408	−13.3	
		3 size/urban	−.0726	−1.0	
		4 non-English speaking	−.2491	−2.9	
		5 Federal/State vocational aid	−.6972	−9.7	
		6 child/adult ratio	−.5766	−7.5	
Practicum-of-living (proportion)	.25	1 affluence, education, professional	−.0013	−.8	883
		2 poverty	−.0210	−14.8	
		3 size/urban	−.0018	−1.3	
		4 non-English speaking	.0084	4.9	
		5 Federal/State vocational aid	−.0056	−3.8	
		6 child/adult ratio	−.0071	−4.6	
Practicum-of-living (per 1,000 students)	.29	1 affluence, education, professional	−.0402	−.4	883
		2 poverty	−1.2756	−13.9	
		3 size/urban	−.3007	−3.3	
		4 non-English speaking	.3085	2.8	
		5 Federal/State vocational aid	−.7109	−7.4	
		6 child/adult ratio	−.8928	−9.1	

Table 2.—Relative teacher demand, by level, specialty, and strength of individual factors (for teacher specialties producing overall R^2 of .15 or higher)—continued

Teacher specialty, by level	R^2	Factors	Coefficient estimate	t ratio	n
Elementary (continued)					
Math/Science (proportion)	.16	1 affluence, education, professional	.0061	5.4	883
		2 poverty	.0007	.7	
		3 size/urban	.0019	2.0	
		4 non-English speaking	−.0070	−5.9	
		5 Federal/State vocational aid	−.0091	−9.0	
		6 child/adult ratio	.0031	2.8	
Math/science (per 1,000 students)*	.13	1 affluence, education, professional	.7581	5.5	883
		2 poverty	−.1908	−1.5	
		3 size/urban	−.0896	−.7	
		4 non-English speaking	−.6095	−3.9	
		5 Federal/State vocational aid	−1.1823	−9.0	
		6 child/adult ratio	−.4939	−3.6	
Vocational education (proportion)	.43	1 affluence, education, professional	−.0190	−10.6	883
		2 poverty	.0328	20.3	
		3 size/urban	−.0087	−5.5	
		4 non-English speaking	−.0141	−7.0	
		5 Federal/State vocational aid	.0129	7.9	
		6 child/adult ratio	.0033	1.9	
Vocational education (per 1,000 students)	.31	1 affluence, education, professional	−.9234	−8.0	883
		2 poverty	1.6686	16.0	
		3 size/urban	−.6826	−6.6	
		4 non-English speaking	−.5403	−4.1	
		5 Federal/State vocational aid	.5010	4.8	
		6 child/adult ratio	−.0334	−.3	
Problem-learner (proportion)	.15	1 affluence education, professional	.0003	.5	883
		2 poverty	−.0001	−.2	
		3 size/urban	.0048	7.4	
		4 non-English speaking	.0073	10.0	
		5 Federal/State vocational aid	−.0004	0.6	
		6 child/adult ratio	−.0015	−2.3	
Problem-learner (per 1,000 students)*	.13	1 affluence, education, professional	.0427	1.0	883
		2 poverty	−.0430	−1.1	
		3 size/urban	.2632	6.2	
		4 non-English speaking	.3757	7.8	
		5 Federal/State vocational aid	−.1091	−2.7	
		6 child/adult ratio	−2065	−4.9	

* Overall R^2 for this equation was somewhat less than .15. It is included here because its matching demand variable was above the .15 cutoff.

Math/Science Teachers (Secondary)

For secondary math/science teachers, the high education/affluence/professional factor is associated with high demand. Also, Federal/State funding of vocational education and percent persons from non-English-speaking background factors are negatively associated with this teacher demand variable. Greater demand for secondary math/science teachers can be found in highly educated, affluent, professional communities with low concentrations of persons from non-English-speaking backgrounds and low vocational education funding.

Problem-Learner Teachers (Secondary)

High density urban areas seem to require more problem-learner teachers, as do areas with high percents of persons with non-English-speaking backgrounds. A community fitting both descriptions would therefore be predicted to hire more of these teachers.

Vocational Education Teachers (Secondary)

Equations for these teachers had the highest R^2 in the study. High levels of poverty and Federal/State funding of vocational education are both strong predictors of demand for vocational education teachers. Low education levels with little affluence and few professionals also predict demand for these teachers, as do small rural size and a low percentage of persons with non-English-speaking backgrounds.

Therefore, a community that is poor, rural, nonprofessional, and low in education level, having few persons from non-English-speaking backgrounds and high funding for vocational education would be expected to have a high demand for these teachers.

Contingency Tables:

A Different Look at the Association Between Factor and Demand Variables

In the regression analysis, an overall finding of a significant relationship between the factors and the demand variables tells the reader that a linear relationship exists. However, other relationships that do not exactly follow a linear pattern may not be disovered by the regression approach. By cutting the distribution of a factor variable and a demand variable into quartiles and crosstabulating them, another picture of the relationship is revealed. This is why the contingency table analysis approach was tried.

When examining the crosstabulations, the reader should keep in mind that if the variables are independent, then the expected proportion for each cell is .25. A large deviation from .25 indicates evidence of a relationship between the factor and the demand variable. Because of the large number of tables this analytic approach generated, only those tables with strong evidence of a relationship are provided here.

Elementary Culture Teachers per 1,000 Students

The poverty crosstabulation (table 3) indicates that very few of the poorest districts (10.7 percent) fall in the top quartile of demand for culture teachers. It shows likewise that 42.2 percent of the wealthiest districts fall in the highest quartile of demand for culture teachers. Following from these figures, 34.3 percent of the poorest districts fall in the bottom quartile for demand for culture teachers, but only 14.6 percent of the wealthiest districts fall in that bottom quartile.

The child/adult ratio factor shows only one very deviant cell; that is, 38.5 percent of districts with the lowest child/adult ratios fall in the top quartile for culture teachers.

The crosstabulation on the percent of persons with non-English-speaking backgrounds shows that districts with large non-English-speaking populations have a low demand for culture teachers. When these districts are broken down, 17.8 percent are found in the top quartile for teacher demand, whereas 37.9 percent fall in the bottom quartile.

The Federal/State vocational funding crosstabulation, like the non-English-speaking crosstabulation, reveals a low demand for culture teachers in communities receiving a great deal of vocational education aid (12.4 percent fell in the top-demand quartile; 33.1 percent fell in the bottom demand quartile).

Table 3.—Quartile distribution of elementary culture teachers per 1,000 students, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of elementary culture teachers per 1,000 students				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
1. Education, affluence, professional	1. Most educated, affluent, professional	32.68	26.34	17.56	23.41	892
	2.	22.22	24.44	26.67	26.27	
	3.	23.56	20.00	31.56	24.89	
	4. Least-educated, affluent, professional	22.46	28.81	24.15	24.58	
2. Poverty	1. Poorest	10.67	22.71	32.27	34.26	892
	2.	23.56	29.33	24.44	22.67	
	3.	28.13	26.34	20.09	25.45	
	4. Wealthiest	42.19	20.83	22.40	14.58	
4. Percent persons with non-English-speaking background	1. Highest percent	17.76	19.63	24.77	37.85	892
	2.	32.19	24.89	22.32	20.60	
	3.	30.63	27.93	23.42	18.02	
	4. Lowest percent	18.92	27.03	30.18	23.87	
5. Federal/State vocational education aid	1. Highest amount vocational education aid	12.41	27.59	26.90	33.10	892
	2.	21.07	23.97	28.10	26.86	
	3.	31.62	20.55	24.90	22.92	
	4. Lowest amount vocational education aid	29.48	28.69	21.51	20.32	
6. Child/adult ratio	1. High child/adult ratio	16.74	30.32	28.05	24.89	892
	2.	18.83	21.97	31.84	27.35	
	3.	25.79	24.43	25.34	24.43	
	4. Low child/adult ratio	38.50	23.01	15.49	23.01	

The affluence, education, professional crosstabulation shows a high demand for culture teachers in communities strongly bearing those traits.

Secondary Culture Teachers as a Proportion

The poverty factor (table 4) shows only 7.8 percent of the poorest school districts fall in the top quartile for demand for culture teachers, whereas more than half of these districts fall in the bottom quartile for demand. Conversely, 33.8 percent of the wealthiest districts fall in the top quartile and only 14.3 percent of them in the bottom.

A strong association is found also between educated, affluent, professional communities and high demand (for example, 44.7 percent of these communities fall in the top quartile for culture demand). A similar correlation is found between low vocational education funding and culture demand (36.5 percent of the lowest vocational education-funded communities are in the top quartile for culture demand).

Secondary Practicum-of-Living Teachers as a Proportion

The crosstabulations (table 5) show that as poverty decreases, the proportion of districts falling in the high demand for practicum teachers quartile increases dramatically (10.6 percent to 40.7 percent).

The crosstabulations also show that communities with low child/adult ratios are underrepresented in the low-demand quartile (16.4 percent); that low vocational funding is associated with a higher demand for these teachers (30.5 percent fall in the highest category for demand, 14.5 fall in the lowest); and that 36.6 percent of communities with low concentrations of persons from non-English-speaking backgrounds fall in the low-demand category.

Secondary Math/Science Teachers as a Proportion

High concentrations of persons from non-English-speaking-backgrounds (table 6) are associated with low demand for math/science teachers (14.9 percent of the highest percent of non-English speaking fall in the top-demand quartile and 39.8 percent fall in the bottom-demand quartile).

High Federal/State vocational funding shows a similar pattern (16.9 percent of those in the highest quartile for funding fall in the top-demand quartile while 39.2 percent fall in the bottom-demand quartile).

Elementary Physical Education Teachers as a Proportion

In the crosstabulations(table 7), poverty plays a part in determining demand: the poorer the community, the less the demand for physical education teachers. Also, high concentrations of persons from non-English-speaking backgrounds are associated with low demand for physical education teachers at this level.

Table 4.—Quartile distribution of secondary culture teachers as a proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of secondary culture teachers as a proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
1. Education, affluence professional	1. Most educated, affluent, professional	44.70	24.88	17.51	12.90	938
	2.	17.45	26.38	31.06	25.11	
	3.	18.83	24.27	31.80	25.10	
	4. Least educated, affluent, professional	20.65	25.10	21.05	33.20	
2. Poverty	1. Poorest	7.76	15.51	25.71	51.02	938
	2.	25.32	25.75	26.18	22.75	
	3.	33.62	31.00	27.07	8.30	
	4. Wealthiest	33.77	29.00	22.94	14.29	
5. Federal/State vocational education aid	1. Highest amount vocational education aid	17.25	23.53	31.37	27.84	938
	2.	20.56	29.03	20.97	29.44	
	3.	28.09	19.57	27.23	25.11	
	4. Lowest amount vocational education aid	36.50	29.00	21.50	13.00	

Table 5.—Quartile distribution of secondary practicum-of-living teachers as proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of practicum-of-living teachers as proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
2. Poverty	1. Poorest	10.61	12.65	31:43	45.31	938
	2.	19.31	23.18	32.62	24.89	
	3.	30.57	35.37	18.34	15.72	
	4. Wealthiest	40.69	29.87	17.32	12.12	
4. Percent persons from non-English-speaking backgrounds	1. Highest percent	27.60	24.89	26.70	20.81	938
	2.	28.69	34.60	22.36	14.35	
	3.	28.21	23.50	21.37	26.92	
	4. Lowest percent	16.26	17.48	29.67	36.59	
5. Federal/State vocational education aid	1. Highest amount vocational education aid	23.14	21.18	20.78	34.90	938
	2.	22.58	26.21	27.02	24.19	
	3.	24.68	24.26	27.23	23.83	
	4. Lowest amount vocational education aid	30.50	29.30	25.50	14.50	
6. Child/adult ratio	1. Highest child/adult ratio	19.64	25.00	23.66	31.70	938
	2.	18.07	23.53	28.99	29.41	
	3.	28.57	26.89	21.85	22.69	
	4. Lowest child/adult ratio	33.61	24.37	25.63	16.39	

Table 6.—Quartile distribution of secondary math/science teachers as proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of secondary math/science teachers as proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
4. Percent persons from non-English-speaking background	1. Highest percent	14.93	16.74	28.51	39.82	938
	2.	27.43	27.85	24.89	19.83	
	3.	26.92	26.50	24.79	21.79	
	4. Lowest percent	29.67	28.46	22.36	19.51	
5. Federal/State vocational education aid	1. Highest amount vocational education aid	16.86	19.61	24.31	39.22	938
	2.	24.19	24.19	27.02	24.60	
	3.	30.64	28.09	22.98	18.30	
	4. Lowest amount vocational education aid	29.50	29.50	26.00	15.00	

Table 7.—Quartile distribution of elementary physical education teachers as proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of elementary physical education teachers as proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
2. Poverty	1. Poorest	13.94	22.71	35.06	28.29	892
	2.	24.44	28.44	17.78	24.89	
	3.	25.45	23.21	24.55	27.68	
	4. Wealthiest	39.58	26.56	20.83	17.19	
4. Percent persons from non-English-speaking backgrounds	1. Highest percent	16.36	23.83	22.90	36.92	892
	2.	30.04	20.60	23.18	23.18	
	3.	33.33	28.38	21.27	20.27	
	4. Lowest percent	19.82	27.48	32.88	19.82	

Elementary Problem-Learner Teachers As A Proportion

The size of the percentage of persons from non-English-speaking backgrounds in a community has a strong influence in determining demand for elementary problem-learner teachers (table 8). When this percentage is highest, these teachers are in greatest demand (40.19 percent of the highest-demand quartile came from that group). As this percentage goes down, the demand for these teachers diminishes (only 16.2 percent of the highest-demand group are found in communities with the lowest percentage of persons from non-English-speaking backgrounds).

Secondary Problem-Learner Teachers Per 1,000 Students

The urban/size factor of a community shows a strong and interpretable pattern (table 9). When urbanicity and size are great, secondary problem-learner teachers are in high demand (33.0 percent in top quartile). When small rural communities predominate, these teachers are in lower demand (20.8 percent in top quartile).

The size of the percentage of persons from non-English-speaking backgrounds also shows a relationship to demand for these teachers. Of the high-demand quartile, 38 percent are found in communities with the highest concentration of persons from non-English-speaking backgrounds, while 18.7 percent are in communities with the lowest concentration.

Secondary Vocational Education Teachers As A Proportion

Five out of the six crosstabulations showed strong interpretable associations with demand for vocational education teachers (table 10). Communities that are small and rural with low levels of education, affluence and professionals, low concentrations of non-English-speaking persons, and high levels of Federal/State funding for vocational education seem to have the greatest demand for these teachers.

The Cluster Groups

In both the multiple regression and the contingency table approaches, factors representing the demographic characteristics of school districts were associated with the teacher demand variables. In the cluster analysis technique, the school districts themselves are grouped according to their demographic characteristics, and the mean teacher specialist demand for the groups are compared.

Table 11 presents the means for the cluster groups for each demand variable and a short statistical profile of each group. A description of each group according to Scholastic Inc. can be found in appendix I.

Table 8.—Quartile distribution of elementary problem-learner teachers as proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of elementary problem-learner teachers as proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
4. Percent persons from non-English-speaking backgrounds	1. Highest percent	40.19	21.03	16.82	21.96	892
	2.	25.32	26.18	24.03	24.46	
	3.	19.37	25.23	27.93	27.48	
	4. Lowest percent	16.22	27.93	30.63	25.23	

Table 9.—Quartile distribution of secondary problem-learner teachers per 1,000 students, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of secondary problem-learner teachers per 1,000 students				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
3. Urban/size	1. Most urban/largest	33.05	24.69	23.85	18.41	938
	2.	22.69	25.00	28.70	23.61	
	3.	23.61	25.32	29.61	21.46	
	4. Least urban/smallest	20.80	25.60	18.80	34.80	
4. Percent persons from non-English-speaking backgrounds	1. Highest percent	38.46	23.08	17.65	20.81	938
	2.	23.63	32.49	24.05	19.83	
	3.	20.51	25.21	28.21	26.07	
	4. Lowest percent	18.70	19.92	29.67	31.71	

Table 10.—Quartile distribution of secondary vocational education teachers as proportion of total teachers, by quartile distribution of factors

Factor number	Quartile distribution of factors	Quartile distribution of secondary vocational education teachers as proportion of total teachers				
		Highest quartile	Second quartile	Third quartile	Lowest quartile	n
1. Education, professional, affluence	1. Most educated, affluent, professional	10.6	21.20	28.57	39.63	938
	2.	25.96	25.53	28.09	20.43	
	3.	25.94	31.38	25.94	16.74	
	4. Least educated, affluent, professional	35.63	21.86	18.62	23.89	
2. Poverty	1. Poorest	50.61	26.53	18.78	4.08	938
	2.	20.60	27.04	29.61	22.75	
	3.	16.59	20.96	25.33	37.12	
	4. Wealthiest	10.82	25.11	27.27	37.48	
3. Urban/size	1. Most urban/largest	22.18	29.29	30.54	17.99	938
	2.	17.13	25.00	28.70	29.17	
	3.	20.60	24.03	21.89	33.48	
	4. Least urban/smallest	38.40	22.00	20.00	19.60	
4. Percent persons from non-English-speaking backgrounds	1. Highest percent	23.08	22.17	28.96	25.79	938
	2.	16.46	24.47	26.16	32.91	
	3.	22.22	28.63	23.50	25.64	
	4. Lowest percent	37.40	24.80	22.36	15.45	
5. Federal/State vocational education aid	1. Highest amount vocational education aid	34.12	26.67	21.18	18.04	938
	2.	25.00	25.00	29.03	20.97	
	3.	23.83	28.09	21.23	26.81	
	4. Lowest amount vocational education aid	15.00	19.50	29.50	36.00	

Table 11.—Comparison of cluster group means for variables showing strong differences across groups* and statistical profile of cluster groups

Variable	Group 1 mean n=12	Group 2 mean n=78	Group 3 mean n=147	Group 4 mean n=81	Group 5 mean n=142	Group 6 mean n=171	Group 7 mean n=254	Group 8 mean n=122
Elementary teachers								
Culture, as a proportion	.090	.061	.051	.048	.049	.044	.041	.029
Math/science, per 1,000 students	3.048	.466	.758	.798	.828	.743	.860	1.499
Physical education as a proportion	.047	.035	.029	.028	.027	.027	.026	.022
Secondary teachers								
Culture, per 1,000 students	8.895	7.798	6.686	7.167	6.779	6.070	6.641	4.415
Practicum-of-living per 1,000 students	4.684	6.130	6.466	6.792	6.820	5.843	6.618	3.766
Problem-learner per 1,000 students	1.234	1.372	1.722	2.394	1.712	1.654	1.489	1.223
Vocational education as a proportion	.036	.047	.064	.059	.069	.092	.099	.157
Demographic characteristics								
Percent urban	.862	.901	.832	.932	.818	.707	.440	.289
Percent rural non-farm	.135	.096	.154	.064	.168	.268	.457	.599
Percent rural farm	.003	.003	.014	.004	.014	.025	.103	.112
Percent below U.S. median income	.182	.264	.379	.376	.398	.513	.593	.729
Percent some college	.501	.382	.285	.252	.197	.215	.169	.112
Percent on welfare	.014	.023	.036	.041	.037	.049	.047	.094
Percent high school dropouts	.059	.073	.116	.132	.136	.149	.158	.255
Percent professionals	.449	.353	.285	.264	.219	.229	.195	.165
Percent blue collar workers	.267	.342	.423	.453	.516	.505	.526	.606
Percent earn less than $4,000/yr.	.041	.063	.095	.095	.093	.144	.183	.304
Percent earn more than $25,000/yr.	.275	.113	.057	.082	.035	.034	.025	.016
Per pupil expenditure for instruction	$1,206	$1,138	$1,018	$1,014	$ 940	$ 917	$ 833	$ 756
Federal vocational education aid (expressed as total aid/total pupils)	$ 3.34	$ 7.24	$ 8.40	$ 7.21	$ 7.54	$11.16	$7.27	$19.44
Average elementary enrollments	4,713	4,582	15,538	22,184	7,037	9,018	3,564	4,086
Average secondary enrollments	3,590	4,842	10,840	17,924	5,031	6,893	2,478	2,565
Percent of total pupils in non-English-speaking programs	.007	.008	.009	.014	.008	.006	.007	.009

* Analysis of variance used to test for differences in demand variable. All demand variables represent significant overall F.

As you move from group 1 to group 8, certain trends emerge in the profile. Wealth decreases steadily as you move from 1 to 8. So do the level of education, the percent of population engaged in professional jobs and the per pupil expenditure for instruction. On the other hand, vocational aid generally increases as you move from group 1 to 8, as do the percent of persons below U.S. median income, the percent on welfare, and the percent of high school dropouts. The largest, most urban district is in the middle (cluster 4). The smallest, most rural districts are at the end (clusters 7 and 8). Cluster 1 is fairly small (third from the bottom) and fairly metropolitan (third in urbanicity).

Most of the associations found in the other two statistical techniques are repeated here. Culture teachers at both the elementary and secondary-levels are found more frequently in the wealthier, more educated districts. Vocational education teachers are found most frequently in communities with high Federal/State vocational funding, high levels of poverty and low density (rural) population.

Unlike the findings in the other two techniques, practicum-of-living teachers are in highest demand for the middle clusters (moderate in wealth, education and Federal/State vocational funding and highest in size/urban and percent students in non-English-speaking programs[4] and the lowest demand for these teachers is found at both extremes of the cluster distribution.

As in the findings in the contingency tables, the demand for elementary physical education teachers is greatest where wealth is high.

Conclusions

Agreement between all three techniques was found for elementary and secondary culture teachers, vocational education specialists, and problem-learner teachers. That is, all three techniques showed that greater demand for elementary and secondary culture teachers was found in districts where wealth, education level, and number of professionals were high. All three agreed that proportionately more vocational education teachers were hired in small rural districts where education level, affluence and number of professionals were low, poverty was high, and Federal/State funding of vocational education was high.

Problem-learner teachers, according to all three techniques, could be found most frequently in large urban districts with high concentrations of persons from non-English-speaking backgrounds.

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[4]This variable differs from the percent of persons from non-English-speaking backgrounds factor in that it only counts pupils in programs. The factor counts concentrations of persons from non-English-speaking backgrounds in the community as a whole, as well as this variable.

Two of the methods agreed for practicum-of-living teachers (secondary) and physical education teachers (elementary). The contingency tables and the regression analyses both found the greatest demand for secondary practicum-of-living teachers to be in relatively well-off districts with high child/adult ratios. The cluster analysis and contingency tables both found the greatest demand for physical education teachers to be in relatively wealthy districts.

All three methods found little or no association between sociodemographic variables and demand for the following teacher specialists: practicum-of-living teachers (elementary), core teachers (elementary and secondary), special education teachers (elementary and secondary), and physical education teachers (secondary).

With the demand for teachers changing so dramatically and quickly, it will be helpful to look at those changes more closely using one or more of the methods explored above.

Limitations of the Data

The findings for this report were generated using 1970 census data, 1976-66 Merged Federal File data and 1979-80 CCD LEA non-fiscal data for the demographic variables, and 1979-80 Teacher Demand and Shortage data. The discrepancy in data collection dates could explain why the results found were only modest.

When using the results found here to evaluate an entire school district staffing pattern, be cautious. Although the findings demonstrate the potential relationship between one type of teacher specialist with demographic variables, the models were not designed to be additive across specialists. More specifically, for example, the proportion of math/science teachers hired is not independent of the proportion of vocational education teachers hired. The models for each specialty have been developed independently of the other specialties.

The data presented in this report are not weighted to correspond to population estimates, even though the sample design for the teacher demand survey resulted in unequal probabilities of selection for the LEA's. The data were not weighted primarily because of the complexity of the task. Some of the school districts had to be dropped from one analysis and not others, some from all the analyses (see appendix III). The failure to weight the data can be partially supported by the fact that the analyses were model-dependent and no national estimates of totals or means were provided.

Two broad categories of error occur in the statistics reported: sampling and non-sampling errors. Sampling errors occur because observations are made only on samples of school districts, not on all school districts. Sampling errors do not apply to the census data. Non-sampling errors occur not only on sample surveys, but also in complete censuses of entire populations.

Non-sampling errors can be attributed to many sources: inability to obtain complete information (e.g., some refuse to participate, some participate but answer only certain items, etc.); ambiguities in definitions; differences in interpretation of questions; inability or unwillingness to provide correct information; mistakes in recording or coding data; and other errors of collection, response, processing, coverage, and estimation of missing data.

The statistical techniques used in this report, in combination with the complex sample design and data comparability problems, make error statements difficult to formulate. The statistical measures (e.g., the chi-square) used are based on the assumption that a simple random sample of LEA's was drawn. This assumption is not valid. In fact, because the results were not weighted, the estimates are also subject to biases. The reader should use discretion in applying the results of these analyses.

APPENDIXES

APPENDIX I: School District Cluster Descriptions from Scholastic Inc.[5]

GROUP 1: Mid-Size Suburban Private 4-Year College Preparatory Districts

There are three district clusters in Group 1 and all are characterized by dramatically high levels of education of both parents and students and by dramatically high participation rates in optional pre-ElHi, ElHi and post-ElHi educational programs, particularly in private educational institutions. Almost 40% of the districts are elementary only, the schools are typically organized in K-6, 7-8 and 9-12 units, and most have well-funded supplementary non-remedial/non-vocational educational facilities (such as media learning centers). Over 95% of the districts in the group have more than 300 students, even though only 20% of the students are enrolled in districts containing 10,000 or more students.

GROUP 2: Large, Suburban State University Preparatory Districts

The three district clusters in Group 2 contain districts that are significantly larger and therefore significantly more heterogenous than the districts in Group 1. Parents have high educational levels; many have college degrees. Student enrollments in pre/post-ElHi educational programs are significantly above the national average with college enrollment particularly high. Enrollment in non-public ElHi institutions is high but not as high as might be expected in terms of the wealth and education level of the parents. School buildings are predominantly organized in K-6, 7-8 and 9-12 units; about a third of the districts are elementary only. More than 50% of the students in this group are enrolled in districts having over 10,000 students; only about 7% of the districts have less than 300 students.

GROUP 3: Large, Urban Community College Preparatory Districts

The five district clusters in Group 3 are characteristically located in the West and as such are the only newer, more affluent urban districts. Although the parents in these districts are only slightly better educated than national norms, they are significantly better educated as compared with parents in the typical large city school district. Specifically, the proportion of over 25-year-olds with 4 or more years of college is almost comparable to the proportions in Groups 1 and 2. Similarly, the districts in these urban communities have instructional material funding levels somewhat higher than national averages and significantly higher than other urban districts. The proportion of students enrolled in non-public ElHi school in the urban districts of Group 3 is, for example, one-half the proportion enrolled in the urban districts of Group 4 (11% vs. 22%). Roughly one-quarter of the districts are elementary only; over three-quarters of the students are in districts with over 10,000 students.

GROUP 4: Very Large Urban Vocational/Evening College Preparatory Districts

The eight district clusters in Group 4 are composed of large city districts in the heavy industrial communities of the Middle Atlantic states. As a result, the districts encompass a broad, socio-economic mix of students. Although there is significant affluence in these districts, there are significantly high proportions of families with female head with children under 18, of families below the poverty level with children under 18 and of unemployed minority group high school drop-outs. Those districts have the highest enrollment declines in the nation and have

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5 The U.S. School District Market Segmentation System described in this report was developed by Scholastic Inc., 730 Broadway, New York, NY 10003, under the direction of Richard Cryer, Vice President of Corporate Market Research. Statistical factor analysis and the actual (k-means) clustering were conducted under contract by Claritas Corporation, 1911 North Fort Myer Drive, Rosslyn, VA 22209, under the direction of Samuel Barton, President.

instructional material expenditure levels that are significantly below the national averages. Uncharacteristic of school organization in Groups 1-6, Group 4 has a dramatically high proportion of elementary schools organized in K-8 (versus K-6) units. The proportion of students enrolled in non-public ElHi educational institutions is the highest in the country and twice that of the urban districts in Group 3 (22% vs. 11%). The districts have a high proportion of vocational and special education schools. Over 85% of the students are in districts having over 10,000 students.

Mid-Size Urban Vocational/Evening College Preparatory Districts

The five district clusters in Group 5 have a broad range of characteristics at the national norms. As such, the district clusters in Group 5 tend to be disperate and not amenable to unique or meaningful charactorization, other than to say they tend to be representative of the "average" American public school system. The districts tend to be located, of course, in the major metropolitan centers of the U.S. and tend to be composed of students and parents with "average " educational attainment and expectations. Approximately 60% of the students attend districts with over 10,000 students; approximately 5% of the districts have under 300 students. One-fifth of the districts in Groups 5 are elementary and school buildings are typically organized in K-6, 7-8 and 9-12 units. Approximately 10% of the students in Group 5 are enrolled in non-public ElHi schools. All of the above cited statistics are close to or slightly above national U.S. norms.

Group 6: Mid-Size Outlying Area, Vocational (Post-Secondary) Preparatory Districts

The Group 6 district clusters are composed of, characteristically, county and municipal districts located in the out-lying areas of the Central and South Atlantic parts of the United States. The districts encompass many new or recently expanded group-quarter communities in the sun-belt with families slightly above the national average in educational level, age and affluence. Group 6, moreover, is the only cluster group containing up-scale metropolitan school districts. However, pro-ElHi, ElHi and post-ElHi enrollment proportions are slightly below the national norms, particularly and significantly in private institutions. High school graduation rates and the employment rates of 16-21 year olds are well above the national averages, nonetheless. The district in Group 6, despite their more outlying nature, are organized similarly to the districts in Groups 2-5: only about one-quarter of the districts are elementary with schools typically organized in K-6, 7-8 and 9-12 units. Slightly more than 55% of the students are enrolled in districts containing 10,000 or more students; 15% of the districts have less than 300 students. High military enlistment.

GROUP 7: Very Small, Rural Agricultural Vocational (Primarily Secondary) Districts

The eight district clusters in Group 7 are all characterized by significantly low levels of education of both parents and students and by significantly low participation rates in optional pre-ElHi, ElHi and post-ElHi educational programs, particularly in private educational institutions. However, despite the relatively low level or affluence of the districts, instructional material expenditures per pupil are generally well above the national averages for all of the districts in Group 7. More importantly, instructional material expenditure levels when indexed against median income or property tax assessment base levels are the highest in the nation. Districts in Group 7 are more typically unified than the districts of Groups 1-6 (with a substantially smaller proportion of elementary and secondary districts) with schools more likely to be organized in K-8 and 9-12 or K-6 and 7-12 units. Only approximately 15% of the students attend districts with 10,000 or more students and almost 40% of the districts are under 300 students.

GROUP 8: Small, Rural Vocational (Secondary Only) Districts

The five clusters in Group 8 are typically located in the Southern states in rural, poor socio-economically homogeneous laborer communities. As with communities in Group 7 there are dramatically high proportions of trailer park housing with virtually no assessed property tax base. Parents have dramatically low levels of education relative to the national norm. Enrollments in all forms of optional pre-ElHi, ElHi and post-ElHi educational programs are dramatically below national norms and, additionally, enrollment proportions in required ElHi grades are consistently the lowest in the nation. Instructional material expenditure levels, moreover, are also the lowest in the nation even though the districts provide higher than national average support to vocational education. Group 8 has the highest proportion of unified districts in the nation and the schools are more likely to be organized in K-8 and 9-12 or K-6 and 7-12 units (similar to the organization of schools in Group 7). Only slightly more than 10% of the students attend districts with enrollments over 10,000 students even though only one-quarter of the districts contain 300 or few students.

Appendix II

Factor Formation

A principal axis factor analysis, followed by varimax rotation, was used to separate the variables into independent factors. The purpose of the varimax rotation was to approximate simple structure in the factor pattern matrix.

Approximately 60 demographic variables were used as input to the principal axis factor procedure. These variables included data on race/ethnic background, urban/rural status, income, teacher salaries, school revenues and expenditures, Federal and State aid for education, unemployment, welfare aid, school attendance and level of education (see appendix III). The analysis resulted in 18 factors with eigenvalues greater than one. These factors accounted for 72 percent of the variance in the correlation matrix. To delimit the number of variables considered in the regression and contingency table analysis, six factors accounting for 46 percent of the variance were maintained. The factors and their highest loading variables are discussed below. Factor names were chosen to reflect variables with the highest loadings on each factor.

The variables with high positive loadings on factor 1 were education, percent professionally employed and percent earning salary greater than $25,000 per year.[6] The variables with high negative loadings were percent blue collar employed, percent below U.S. median income, and percent earning less than $4,000 per year. The strong positive loading for preschoolers in school and in private school are indicative of the highly educated, high income school districts this factor reflects. A school district with a high score would be affluent, well-educated and professional.

Highest Loading Variables for Factor I
(Affluence, education, professionals)

Highest Loading Variable Name	Loading
Some college	.89
Professionally employed	.88
Preschoolers in private school	.86
Blue collar employed	-.84
Preschoolers in school	.84
Percent families with salaries greater than $25,000 per year	.84
Teacher salary	.56
Percent below U.S. Median income	-.58
Percent households earning less than $4,000 per year	-.37

[6]This is Census data from 1970 when $25,000 was well above the U.S. median income.

The variables that loaded most heavily on factor 2 were poverty indicators (percent age 18 and under falling under Orshansky poverty index, percent below poverty, percent earning less than $4,000 per year, percent on welfare). Education indicators associated with poverty that had high positive loadings were percent high school dropout and percent not enrolled and unemployed. Two education variables negatively associated with poverty had high negative loadings: percent with a high school degree and percent kindergarten age children in school. A school district with a high score on factor 2 would be very poor. One with a very low score on factor 2 would be wealthy.

Highest Loading Variables for Factor 2
(Poverty)

Highest Loading Variable Name	Loading
Percent below Orshansky index for poverty for age 18 or less*	.84
Percent below poverty	.81
Percent high school graduate	-.79
Percent families earning less than $4,000 per year	.77
Percent on welfare	.62
Percent kindergarten-age in school	-.61
Percent high school dropouts	.59
Level elementary/secondary aid	.56
Percent not enrolled/unemployed	.43

*Measure to assess poverty, utilizing over 128 different poverty indicators.

On factor 3, the urban/size factor, the percent farm workers, percent population rural/farm, and percent living in a non-SMSA had high negative loadings, while the percent urban, number of schools and enrollment had high positive loadings. Three variables with fairly high positive loadings, percent private secondary school attendance, percent private elementary school attendance and percent earning less than $4,000 per year, all would be associated with large inner city districts. Therefore, high scores on factor 3 would be found for large, urban school districts.

Highest Loading Variables for Factor 3
Urban/size

Highest Loading Variable Name	Loading
Percent farm workers	-.71
Percent rural farm	-.70
Percent urban	.67
SMSA designation*	-.65
Number of schools	.59
Enrollment	.56
Percent attend private secondary schools	.43
Percent attend private elementary schools	.38
Percent earn less than $4,000 per year	.37

*1 = Central city of SMSA; 2 = noncentral city of SMSA; 3 = nonSMSA.

Factor 4 has been named percent persons from non-English-speaking backgrounds. The high positive loadings for percent Hispanic and percent pupils in non-English-speaking classes, as well as the fairly high positive loading for percent Asiatic, determined the name for this factor. Other variables with positive high loadings, such as unemployment rate, percent on welfare and elementary/secondary aid, would also tend to be associated with recent immigrants.

A high score on factor 4 would be indicative of communities with high concentrations of persons from non-English-speaking backgrounds.

Highest Loading Variables for Factor 4
(Percent persons non-English-speaking backgrounds)

Highest Loading Variable Name	Loading
Percent Hispanic	.66
Percent pupils in classes for non-English speaking	.64
Unemployment rate	.54
Per pupil expenditure administration	.54
Percent on welfare	.49
Level elementary/secondary aid	.46
Percent Asiatic	.34

Four of the seven variables on factor 5 with high positive loadings were associated with State or Federal funding for vocational education (Vocational Education Administration (VEA) Basic grants, VEA Consumer and Homemaking Grants, Federal/State Vocational Education Aid, VEA Work/Study Grants). Furthermore, the highest loading variable for this factor was percent pupils in vocational education classes. A high positive score on factor 5 would indicate that a school district had extensive outside funding for vocational education.

Highest Loading Variables for Factor 5
Federal/State funding for vocational education

Highest Loading Variable Name	Loading
Percent pupils in vocational education	.75
Level vocational education basic grants	.72
Size of school	.54
Level Federal/State vocational education aid	.49
Level vocational education consumer and homemaking grants	.43
Teacher salary	.43
Level vocational education work/study grants	.32

Three variables loaded heavily and positvely on factor 6: percent preschool-age, percent kindergarten-age and percent school-age children. This factor either indicates communities with large families or many families with young children. To reflect the number of children relative to the number of adults, factor 6 was termed child/adult ratio. A high score on factor 6 would indicate that a school district had a high number of children relative to the number of adults.

Highest Loading Variables for Factor 6
Child/adult ratio

Highest Loading Variable Name	Loading
Percent preschool population	.77
Percent kindergarten population	.77
Percent school-age population	.72

Appendix III

Data Sources

Three files supplied the demographic variables that were used in the analyses. They were the 1970 Census Fifth Count File, the 1976-77 Merged Federal File and the 1979-80 Common Core of Data (Part VI). Local Education Agency Nonfiscal Report. These files will be described briefly and the variables they contributed listed.

The 1979-80 Survey of Teacher Demand and Shortage supplied the teacher demand data. That file and how it was modified for use in these analyses is also discussed in greater detail.

Census School District Fifth Count Summary Tape

Data on this file are aggregations of related 1970 Census sample tallies for component enumeration districts (ED) and block groups. Data for ED's split, by school districts, were allocated according to the proportion of housing units on the ED which fell within each school district. Although 1970 Census data were used, the boundaries for the school districts were from 1973-74.

List of variables created from this data base

Percent population:
- in college
- in school
- in kindergarten
- in private preschool
- in private kindergarten
- in private elementary
- in secondary
- high school dropout
- not enrolled/unemployed
- age 16 to 21 enrolled
- having less than high school degree
- having high school degree
- professional or managerial jobs
- white collar/clerical or sales
- blue collar, crafts, operative, services or laborers
- farm related occupation
- below poverty
- on welfare

Unemployment rate, 16-year-olds and up

Median income

1976-77 Merged Federal File

Seven component surveys, including ELSEGIS School District Universe, F-33--Survey of Local Government Finances, OCR--Elementary and Secondary School Civil Right Survey, 437 State Administered Programs, EEO-5--Elementary Secondary Staff Information, NIE Special Tabulations of Census Data and Equalized Property Values, were merged to create this file.

List of variables created from this data base

Per pupil revenue
Revenue from State/pupil
Vocational education aid/pupil
Elementary/secondary aid/pupil
Per pupil expenditure for administration
Teacher salary
Per pupil expenditure for instruction
Type of district, i.e. elementary only, secondary only or combined
Number of schools
Percent population non-English-speaking background
Percent students special education
" students vocational education
" population Asian
" " American Indian
" " Hispanic
" " Black
" " White
" students handicapped
" " migrant
" " delinquent
" " receiving handicap aid
" " " aid from NDEA
" " " aid from Basic Grants
" " " vocational education special need aid
" " " " " research aid
" " " " " innovation and participation
" " " " " home economics aid
" " " " " cooperative program aid
" " " " " work study program aid
" population Orshansky, White
" " Orshansky, Black
" " Orshansky, Hispanic

1979-80 Common Core of Data, Part VI: Local Education Agency Nonfiscal Report

This file supplied information on enrollment by grade and level to produce the per 1,000 student ratio demand variables as well as demographic data on size of school district.

1979-80 Survey of Teacher Demand and Shortage

The Survey of Teacher Demand and Shortage was a sample survey conducted during the 1979-80 school year. The figures in this report are estimates based on the survey. Survey respondents were public school district administrators and administrators of other units, such as private schools and schools operated by State or intermediate agencies to provide vocational or special education. This report is limited to the public school district component of this sample. The figures are based on head counts (not full-time equivalents) of full-time and part-time teachers in the responding units. For the purpose of this survey, persons teaching in more than one field level were reported in the field or level in which they spent most of their teaching time. The exception was that any teacher engaged in bilingual or special education was counted in either of those areas regardless of the time spent in other areas.

Out of approximately 16,000 local education agencies (LEAs) engaged in elementary and secondary education, survey forms were mailed to 1,448 LEAs. NCES received responses from 1,273 LEAs--a response rate of 88 percent.

The sampling frame was stratified by type of sampling unit (LEAs formed one strata). Within that strata, the following other stratifications were used: presence or absence of special education provisions, presence or absence of vocational education provisions, presence or absence of bilingual education coordinator, four geographic regions, three metropolitan status categories and enrollment size of unit.

Each sampling unit was assigned a measure of size approximately proportional to the number of teachers per unit. Some subpopulations were oversampled, since estimates for teachers in critical areas such as special education and vocational education were desired with precision at least as good as in the academic fields. Sampling units were selected with probability proportional to the estimated size measure without replacement within each stratum.

Although the original sample contained 1,273 school districts, many districts had to be dropped from the analyses. This occurred for 247 districts because a match could not be found for them on at least one of the demographic variable files, or because the district was associated with an intermediate district for all its special education and/or vocational education teaching.

For the contingency table analyses, elementary-level specialists were represented by 892 districts and secondary by 938. Districts with elementary-level specialist were either elementary-only or combined districts, with only the elementary-level teachers and elementary-level students used in the analysis. Districts with secondary-level specialists were either secondary-only districts or combined districts, with only the secondary-level teachers and secondary-level students used in the analysis.

Because of the need to trim outliers for the regression analysis, the elementary and secondary demand variables contained 840 and 883 districts respectively.

The cluster analysis technique not only had some minor trimming of outliers, but also some of the districts in the sample that could not be matched against Scholastic's cluster file. The total number of districts for the elementary-level was 870; for the secondary-level, 918.

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